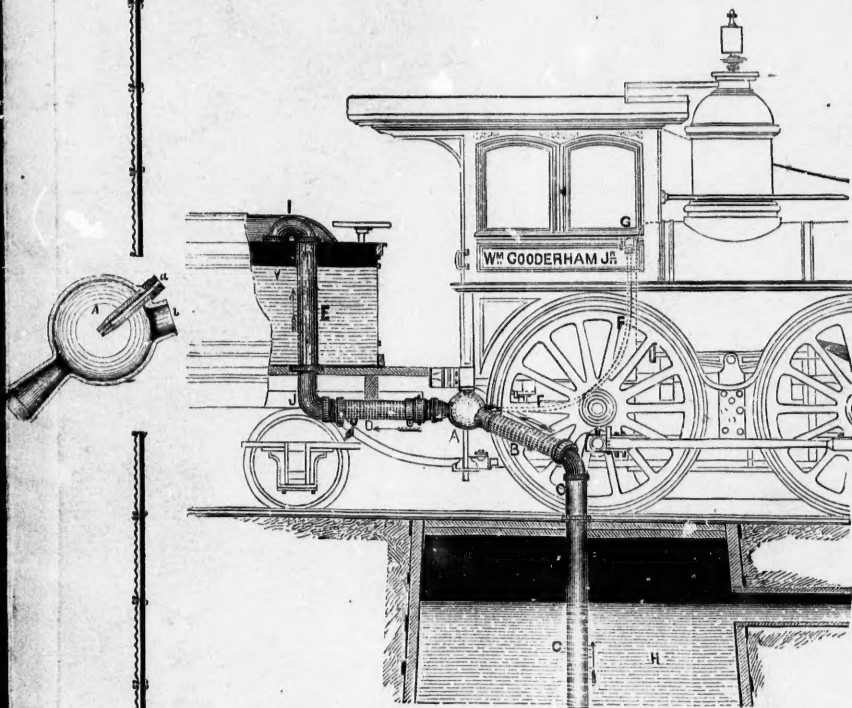


THE
"Haggas Water Elevator,"



For Supplying Locomotive Tenders with Water.

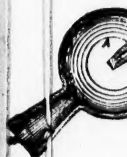
WM. GOODERHAM, JR.,

Managing Director Toronto & Nipissing Railway.

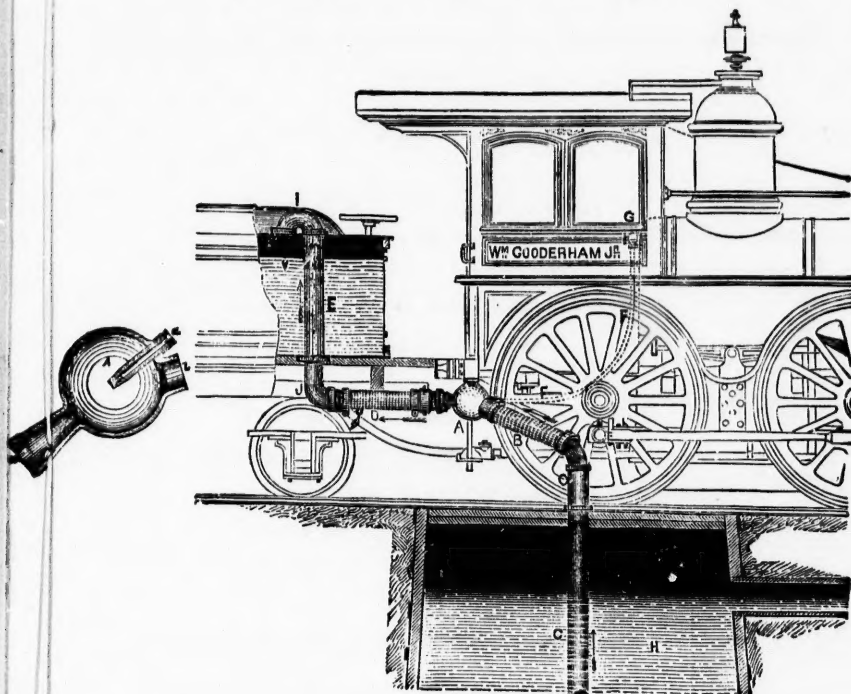
TORONTO :

G. C. Patterson & Co's Steam Print, 48 King St. East.

1880.



THE
"Haggas Water Elevator,"



For Supplying Locomotive Tenders with Water.

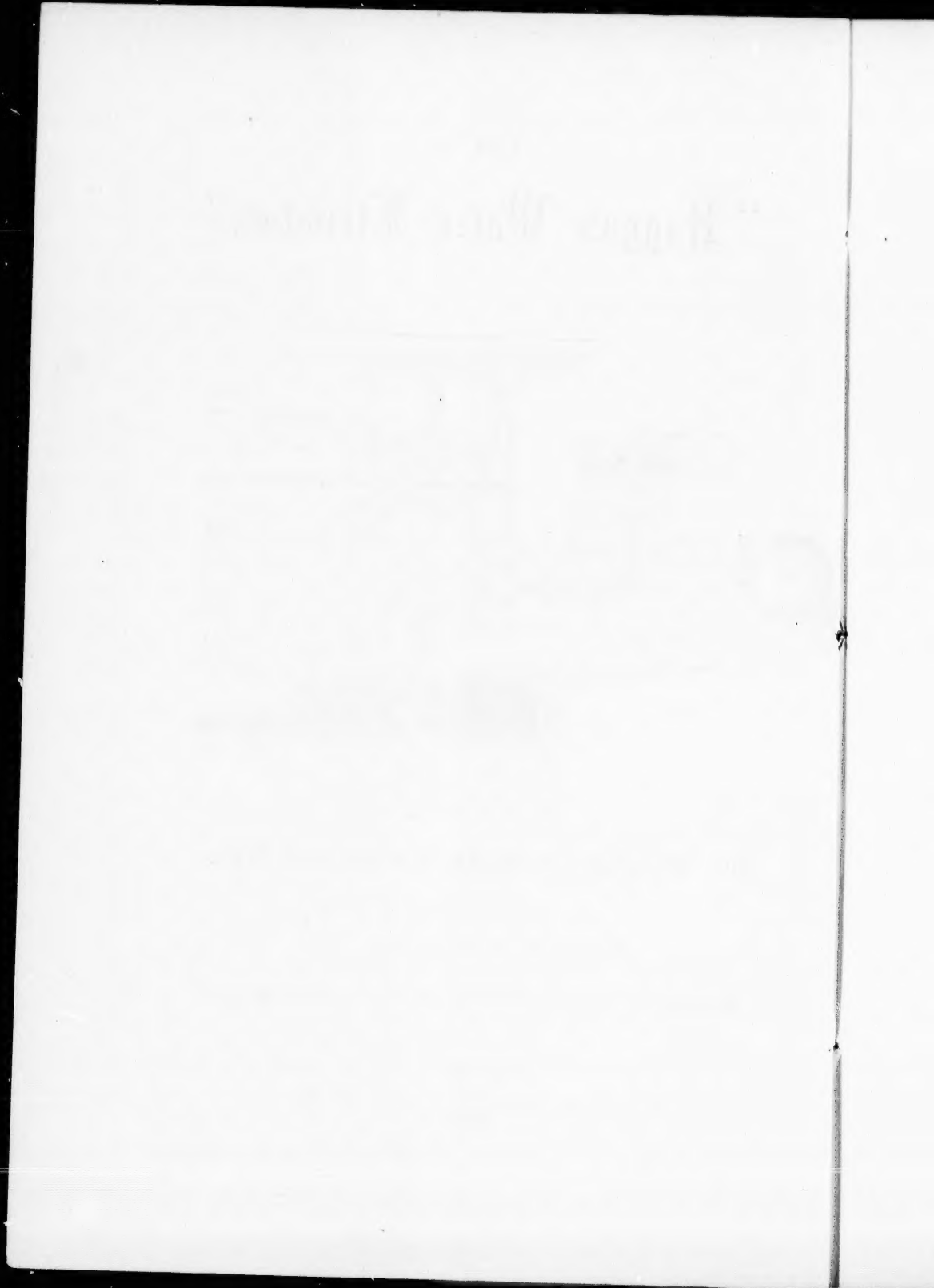
WM. GOODERHAM, JR.,

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TORONTO :

G. C. Patterson & Co's Steam Print, 48 King St. East.

1880.



RAILWAYS

ON WHICH THE

"HAGGAS WATER ELEVATOR"

IS USED THROUGHOUT, WITH THE EXCEPTIONS NOTED.

IN CANADA :

BELLEVILLE, NORTH HASTINGS & GRAND JUNCTION.
(Operated last season by the Grand Trunk Railway Company).

CANADA PACIFIC. (170 miles west of Thunder Bay).

COBOURG, PETERBORO' & MARMORA.

CREDIT VALLEY.

HALIFAX & CAPE BRETON.

MIDLAND OF CANADA.

NORTHERN & NORTH-WESTERN. (In part).

PORT DOVER, STRATFORD & LAKE HURON.

PRINCE EDWARD ISLAND.

PRINCE EDWARD COUNTY.

TORONTO & NIPISSING.

TORONTO, GREY & BRUCE.

VICTORIA.

WESTERN COUNTIES.

WHITBY, PORT PERRY & LINDSAY.

In the United States :

DETROIT, MACKINAC & MARQUETTE.

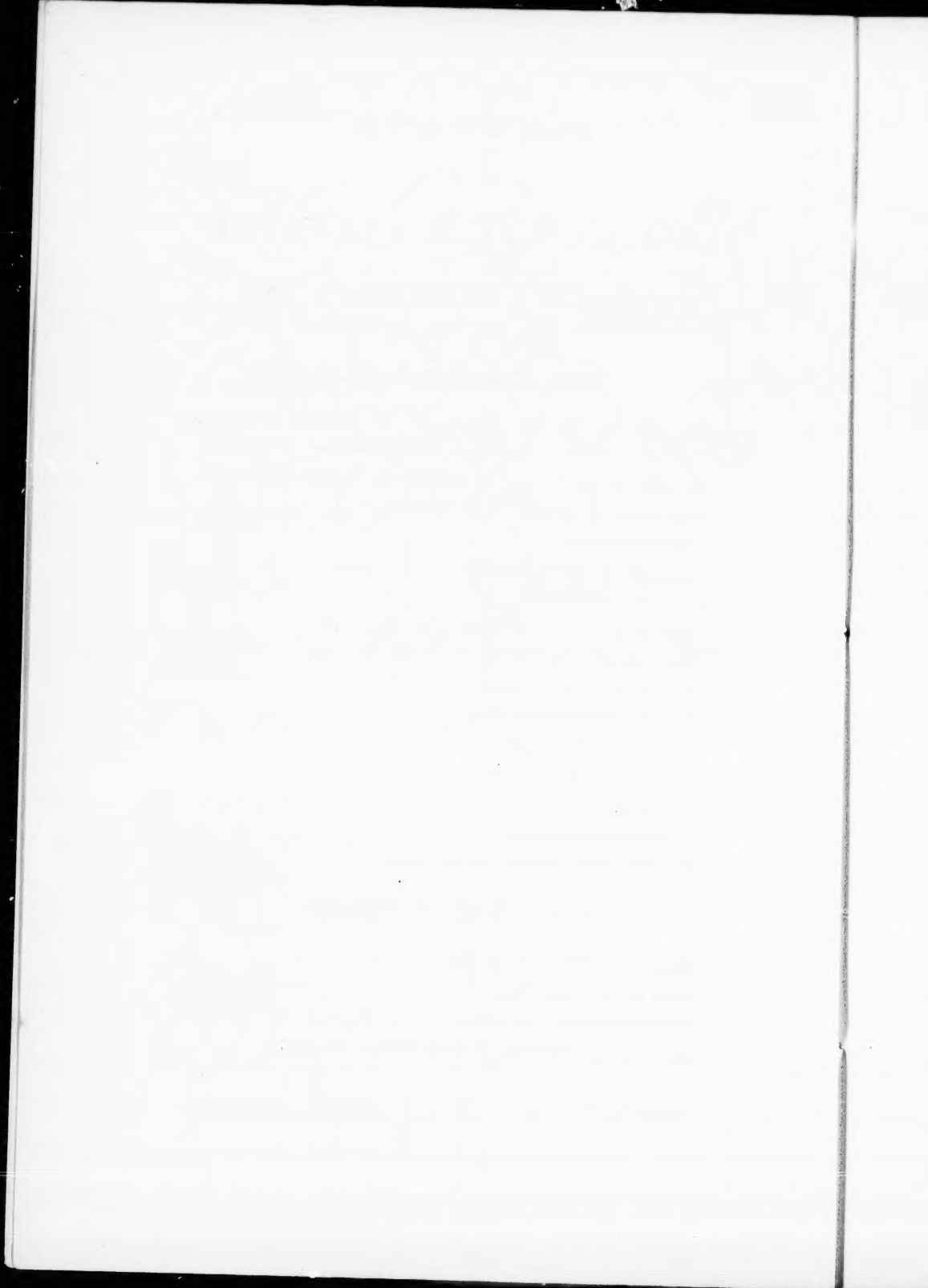
CHICAGO & ATLANTIC.

JERSEY CITY & ALBANY.

NEW YORK, ONTARIO & WESTERN. (In part.)

SUSSEX.

WARWICK VALLEY.



THE
"HAGGAS WATER ELEVATOR,"

—BY WHICH—

Locomotive Tenders may be supplied with water
from underground cisterns at the smallest
possible cost.

THE FOLLOWING CIRCULAR LETTER

*Contains full information with respect to the "HAGGAS
WATER ELEVATOR," and its careful perusal is, there-
fore, earnestly requested :*

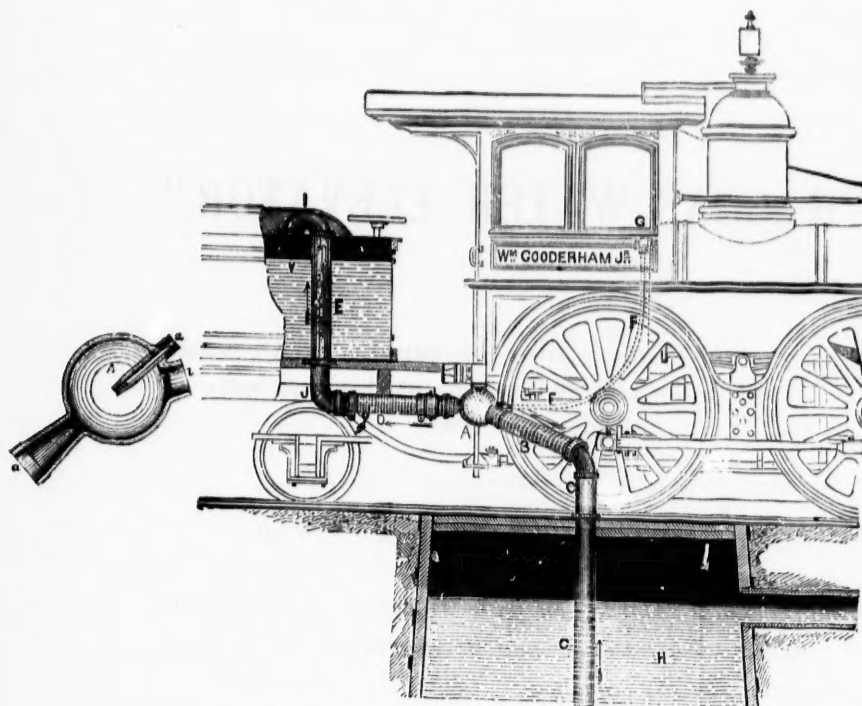
TORONTO & NIPISSING RAILWAY,

MANAGING DIRECTOR'S OFFICE,

TORONTO, ONT., Oct. 15th, 1880.

SIR,—I beg respectfully to bring under your notice, and to submit for your consideration, with a view to its use, the practical and valuable device known as the "HAGGAS WATER ELEVATOR," by which Locomotive Tenders may be supplied with water, from underground cisterns, at the smallest possible cost.

The subjoined illustration indicates the mechanism of the device :—



The injector, A, is a spherically shaped vessel, into which the water is drawn from the source of supply, through a four-inch pipe, by the vacuum formed within the vessel, and from which it is forced through another four-inch pipe, into the Tender, by the action of the steam drawn from the boiler.

The following are some of the leading features connected with the "HAGGAS WATER ELEVATOR," viz. :

1. On roads under construction the entire cost and equipment of Tank Houses, averaging from \$60 to \$100 per mile, and the maintenance, which will average from \$30 to \$50 per mile, annually, are both almost entirely saved.

2. On established roads where Tank Houses are already

built, it saves the maintenance of water service, say from \$30 to \$50 per mile, annually.

3. The cost of the new system is from *ten to fifteen dollars per mile*,—which includes equipping one engine for each ten miles of road, and placing the cisterns fifteen miles apart. The subsequent outlay, for maintenance, is really very trifling.

4. In addition to the above, the temperature of the water put into the Tender is raised 25° or more, without turning the steam directly into the Tender as is the usual practice. The steam used for lifting the water into the Tender heats the water quite as much as if turned in for that special purpose.

5. Surface and swamp water, which is so valuable for steam purposes because of its softness, is readily obtained. It is scarcely necessary to point out to Railway men the injury caused to Locomotive *boilers* by incrustation, through the use of well or spring water impregnated with lime ; or to explain the saving which can be effected, and the satisfactory condition in which the boilers can be kept, when soft water is used.

6. The "HAGGAS WATER ELEVATOR" is remarkable for its simplicity. It is of the utmost importance that everything connected with a device of this description should be as simple, and free from complication, as possible. In view of darkness, storms, and the conditions peculiar to our winter season, it is most desirable that there should not be anything connected with the system liable to get out of repair.

7. The most complete satisfaction is assured with respect to results.

It will be observed, in connection with this system, that plain and inexpensive underground cisterns take the place of the

large and costly frost-proof tanks now in use; and that the expensive and troublesome method of pumping water into the tanks is superseded by the flowing of water from creeks, ponds, &c., conducted by pipes into cisterns placed somewhat below the surface of the water supply.

The water is forced from the underground cisterns to the Locomotive Tender, through a four-inch metal pipe, at the rate of about *four hundred and fifty gallons per minute*. The steam used for this purpose increases the temperature of the water in the Tender, depending upon the depth from which the water is taken, from 20° to 30° . The steam so employed is compensated for by the heat imparted to the water in the Tender; the increased temperature, as already intimated, reaching as high a point as if the steam were turned into the Tender for the sole purpose of warming the water; and it may be further observed that, with a good fire, and the blower on, the necessary supply of water can be taken, without lowering the pressure of steam in the boiler.

The nearer that water can be obtained to the surface the better; but from careful observation and numerous tests, and from the experience of several Railway Companies who have used the new device for about two years past, the evidence is so complete and reliable as to place the matter beyond controversy, that, where the water can be had within *ten feet of the rail*, the results are in the highest degree satisfactory.

Although in most localities water may be procured within less than ten feet below the rail level, it will happen that the water supply in some places must necessarily be taken from a greater depth. This circumstance has been carefully considered, and it is strongly recommended that where water cannot be had within a suitable distance below the rail level, underground cisterns of sufficient capacity be placed within a few feet of the rail, and that the

water be conducted thereto, by gravitation, through pipes connecting with a water supply at a greater elevation—or, when necessary, by the use of windmills or other pumping appliances. It is respectfully urged that, in all cases, underground cisterns be used in preference to overground tanks. It is undoubtedly much more economical, and in every respect more satisfactory, to place the water in inexpensive underground cisterns than to elevate it into costly overground tanks, the latter requiring that the water be raised an additional distance of at least thirty feet. Besides the economical results secured by the uniform use of underground cisterns, the proposed plan has the additional merit of providing for the taking of water at each and every water station by the use of the "HAGGAS WATER ELEVATOR." It is unnecessary to dwell further upon the obvious advantage of *uniformity* in supplying water to Locomotive Tenders.

The evidence in regard to the value and advantage of underground cisterns, under the exceptional circumstances just mentioned, is exceedingly satisfactory. The matter has been thoroughly examined by Civil Engineers, of recognized ability, and Railway men, of extensive and varied experience.

"Col. C. S. Gzowski, C.E., of Toronto, states :—"If pumping has to be resorted to it is more economical to pump into an underground tank, which costs much less than one overground, and which needs no attendance, while the Locomotive being already fitted with the 'HAGGAS' system requires no additional appliances. The 'HAGGAS' system *is unquestionably the most economical and convenient, under almost all circumstances, for the supply of Water Stations.*"

"'HAGGAS' mode of supplying water, where it can be had within the ten feet of rail level, is undoubtedly most economical and efficient, and I unhesitatingly should adopt it on a Railway

under conditions where water can be brought to the Water Stations by gravitation at a cost equal to the expense of erecting frost-proof tanks, pumping apparatus, and the cost of maintaining them."

WALTER SHANLY, ESQ., C.E., of Montreal, reports :—"Where the natural water surface is too low down to be acted on directly, and pumping must be resorted to, a saving will be effected by pumping into an underground tank where the water can be reached by a 'HAGGAS ELEVATOR' pipe, instead of the elevated receiver in general use, and whence the Engine is supplied by gravitation. The first cost of the underground tank will be less, as much as \$1,000 less in most circumstances, than that of the elevated one. The annual cost of maintenance will also be largely in its favour. Economy in these two conditions,—first, cost and maintenance of the Water Station being on the side of the underground tanks ; and, secondly, the superiority of the 'HAGGAS' mode of supplying the Engine Tank,—being admitted, it follows that pumping, where pumping is unavoidable, had better be done into the underground receiver, than into the overground one at thirty feet elevation. I therefore consider that all appearances are now in favour of using the 'HAGGAS WATER ELEVATOR' where pumping has to be done, as well as where the water is naturally within its reach."

O. CHANUTE, ESQ., *Chief Engineer and Asst. Gen. Superintendent of the New York, Lake Erie and Western Railway*, states :—"I was present (on 22nd March, 1880) at a test of the 'HAGGAS WATER ELEVATOR' at Berkeley Street Station, and do certify that an Engine filled her Tender, holding 1,750 gallons of water, in four minutes, without lowering the pressure of steam in the boiler. When water can be had within ten feet of the rail level I see no reason why this system should not be used, especially where there is a necessity for erecting and maintaining expensive elevated tank-houses, and raising the water by pumping."

A further statement was supplied, on the 22nd of September, 1880, by O. Chanute, Esq., as follows :

" I have received your letter, and enclosures containing the opinions of such distinguished Engineers as Messrs. Shanly and Gzowski, concerning the ' HAGGAS WATER ELEVATOR,' as a device for supplying Locomotive Tenders with water from underground cisterns, which are to be filled by gravitation where practicable, and by pumping where the source of supply is more than ten feet below the rail level.

" I can see that in the construction of new lines of Railway the adoption of the ' Haggas ' system may be attended with considerable economy.

" It would save the cost of overground frost proof tanks, and where the water supply is not more than ten feet below rail level dispense with pumping appliances ; while, where pumping is a necessity, it would, upon the whole, be somewhat less expensive to throw the water into underground cisterns than to raise it say thirty feet higher into overground tanks.

" I believe the principal fields for the application of this system will be found to be in the West and South. One great source of expense to Western Railroads arises from the *hardness* of the water which they obtain from wells and springs, the lime and alkali therein contained materially increasing the amount of fuel consumed, and the cost of Engine repairs. It is advisable, in my judgment, wherever the country admits of it, to store the rain water in artificial ponds (generally cheaply secured), from which it may flow into underground cisterns.

" When this method of supply can be adopted, as a general plan, the ' Haggas ' system may be the most economical method of taking the water from the ponds or the underground cisterns

into the tender, thus dispensing with all investments in tanks, pumps, pipes, etc.; and in such case, for the sake of uniformity, as well as in view of the greater cheapness of first cost, I believe that, even when pumping is necessary, it would be advisable to pump into an underground cistern, rather than into an overground tank.

"In those locations also, either in yards or at large stations, at which overground tanks would be in the way of the connection or extension of tracks, it will frequently be preferable to substitute underground cisterns.

"Under what other circumstances the new system will prove preferable will be a question mainly to be solved by actual test and experience.

"Respectfully,

"O. CHANUTE."

The WESTERN RAILROAD ASSOCIATION, of Chicago, Ill., U.S., which represents about eighty of the United States Railways situate west of Buffalo, submitted the "HAGGAS WATER ELEVATOR," for careful examination and report, to a Committee of *Experts*, namely: Messrs. E. P. Alexander, G. W. Tilton, and E. T. Jeffrey. The Report of these gentlemen, prepared after three separate tests had been made, contains much interesting detail, and closes as follows:—

"There would be an advantage, the amount of which must be determined by actual experiment, in feeding the boiler of an Engine with water heated to the temperature shown in the foregoing tables by use of the elevator.

"At the expiration of one hour and forty-five minutes after the third test, with the temperature of the air at 64°, the heat of water in the Tender had decreased but two degrees.

"We are of the opinion that the same quantity of steam used by the elevator in filling and heating the water in the tank, would, if turned directly into the tank, practically heat the water to an equal temperature.

"At points where the device is practicable, the maintenance of waterworks and tanks, and the labour and fuel will be dispensed with, and a saving be effected. On roads under construction the cost of erecting tanks, pumping machinery, &c., could be dispensed with. These items of expense would vary according to the capacity and cost of the plant necessary to furnish a reliable supply of water to the Engines."

Additional testimony, equally strong as the foregoing, might be added to show that, where pumping is a necessity, economy and efficiency are manifestly secured by the uniform use of underground cisterns instead of overground tanks. For further details with respect to this point, and every other advantage claimed for the "HAGGAS" system, you are respectfully referred to the certificates which appear in another part of this pamphlet.

Special attention is directed to the large saving which can be effected by adopting the "HAGGAS WATER ELEVATOR." In the case of a new Railway, the cost of erecting tanks, pumping machinery, &c., as now provided for furnishing water, would be in the vicinity of \$60 per mile, or \$6,000 per 100 miles of Railway; and the subsequent annual outlay for the maintenance of waterworks, &c., is about \$30 per mile, or \$3,000 per hundred miles.

In adopting the "HAGGAS WATER ELEVATOR," the first cost is only about \$10 to \$15 a mile, or \$1,000 to \$1,500 per 100 miles of Railway; and all subsequent expenditure, for maintenance, is so trifling as to be scarcely worthy of mention. The estimate here given is based upon equipping ten Engines, and placing the cisterns fifteen miles apart.

As soon as the efficient and satisfactory working of the "HAGGAS WATER ELEVATOR" is fully understood, and its marvellous cheapness, in contrast with the costliness of the present system, becomes generally known and appreciated, it will undoubtedly be adopted by nearly every Railway Company on this Continent and elsewhere. Its simplicity of construction, and its inexpensiveness, added to its merits, can scarcely fail to secure for it a commanding position as one of the best methods yet introduced for supplying Locomotive Tenders with water.

The "HAGGAS WATER ELEVATOR" is now in operation on, or has been ordered for, about thirty Railways in Canada and in the United States, and is affording *the most complete satisfaction in every instance.*

The season of the year is now at hand when the overground tanks, pumping apparatus, and everything relating to the water service, receive an overhauling, which is usually attended with considerable expense. The present would, therefore, seem to be an opportune time for inviting your careful and special consideration to the undoubted economy connected with the use, and to the positive worth, of the "HAGGAS WATER ELEVATOR."

It may be added that during the prevalence of snow storms, when, in consequence of the depth of the snow, there is difficulty in reaching a neighbouring Water Station, the snow may be rapidly taken up by the "HAGGAS ELEVATOR," and be converted into water as it passes through the "Injector." This feature will at times be attended with decided convenience and advantage. By carrying on the Engine a piece of hose, sixteen or twenty feet in length, water can be obtained at any point, other than a regular Water Station, when it may be found necessary.

The Railways on which the "HAGGAS WATER ELEVATOR" is now in use are as follows, viz. :—

IN CANADA: Toronto and Nipissing; Toronto, Grey and Bruce; Northern and North-Western; Credit Valley; Midland of Canada; Cobourg, Peterboro' and Marmora; Whitby, Port Perry and Lindsay; Prince Edward County; Port Dover, Stratford and Lake Huron; Belleville, North Hastings and Grand Junction; Victoria; Canada Pacific; Prince Edward Island; Western Counties; and Halifax and Cape Breton.

In the UNITED STATES: Jersey City and Albany; Warwick Valley; Sussex; Detroit, Mackinac and Marquette; Chicago and Atlantic; and New York, Ontario and Western.

And arrangements have been made for introducing it on several additional Railways in Canada and the United States.

The Government of the Dominion of Canada have adopted the "HAGGAS" system on the Canada Pacific and Prince Edward Island Railways. It is now in use on the section of the Pacific Railway extending one hundred and seventy miles west of Thunder Bay; and the Grand Trunk Railway of Canada have it in operation on the Port Dover, Stratford and Lake Huron Railway, which is being operated by that Company.

Orders have also been received, and filled, for London, *England*; Melbourne, *Australia*; Norway, *Europe*; and Chili, *South America*.

Certificates and testimonials, received from the undermentioned gentlemen and others, will be found elsewhere in this pamphlet, viz. :—C. S. Gzowski, C. E.; W. Shanly, C. E.; F. Shanly, C. E.; O. Chanute, Chief Engineer and Asst. Gen. Superintendent of the New York, Lake Erie and Western Railway; Edmund Wragge, C. E., General Manager Toronto, Grey and Bruce Railway; Vernon Smith, C. E.; J. C. Bailey, Chief Engineer Credit Valley Railway; W. H. Ellis, C. E.; John Harvie, Traffic

Master, Northern and North-Western Railways; W. C. Holt, Locomotive Foreman, Grand Trunk Railway; Frank Smith, President Northern and North-Western Railways; James Ross, Chief Engineer and Manager, Victoria Railway; Collingwood Schreiber, Chief Engineer of Government Railways, Canada; P. Clarke, Mechanical Superintendent, Northern and North-Western Railways; Geo. A. Cox, President and Managing Director Midland Railway; J. H. Raymond, Secretary Western Railroad Association, Chicago, U. S.; Marcus Smith, Deputy Engineer in Chief Canada Pacific Railway; C. J. Brydges; C. W. Moberly, Chief Engineer Ontario and Pacific Junction Railway; Alexander Manning; M. M. Baron Von Weber, of the Royal Prussian Department of Public Works; and others.

The "HAGGAS WATER ELEVATOR" is manufactured in this City; also, by Messrs. Geo. W. Tift, Sons & Co., Buffalo, N. Y., United States. The appliances, all complete, will be supplied on application to the undersigned, on the shortest notice; and competent men will be provided to fit up the new device, and to give the necessary instructions with respect to its use.

With regard to the merits of the *invention*, and the sufficiency of the *patent rights* covering the same, the following testimony is respectfully submitted:—

"TORONTO, 9th August, 1880.

"DEAR SIR,—Having secured the patents in Canada, United States, England, and the principal European countries for the 'HAGGAS WATER ELEVATOR,' we are in a position to state that there is a material and patentable difference between it and all elevators previously known.

"Owing to the small quantity of steam used by the 'HAGGAS

ELEVATOR' to perform the required service it has succeeded when all others are known to have failed.

"The rapid adoption of the 'Haggas' system is the strongest evidence of the correctness of our statement, and should be sufficient to satisfy anyone capable of considering the matter.

"Yours truly,

(Signed),

"RIDOUT, AIRD & CO.

"WM. GOODERHAM, JR., Esq., Toronto."

Messrs. H. W. Beadle & Co., Solicitors of Patents, and Agents of the WESTERN RAILROAD ASSOCIATION., at Washington, D. C., United States, in their report on the "HAGGAS WATER ELEVATOR," state as follows :

"The patent has two claims.

"The first covers the combination of a spherically shaped vessel, having certain ports and pipes, with a Locomotive boiler.

"This combination, as far as we can discover, after a careful examination in the patents of the United States, Great Britain and France, is entirely new, and hence we are of the opinion that the claim which covers it is valid.

"The second claim covers the combination of an injector, having a jointed suction-pipe and a tender supply-pipe, with a Locomotive boiler.

"This combination also, as far as we can discover, is entirely new, and hence we are of the opinion that the claim which covers it is valid."

After giving descriptions of another device, bearing more or less resemblance to the one in question, and setting forth the

points of difference, Messrs. Beadle & Co. add : " We are of the opinion that the use of your (Haggas) invention will not infringe any living patent."

I shall be pleased to furnish you, on application, with any further information you may desire, or send to you drawings setting forth more minutely the details of the device. I shall also be happy to show you the system in full operation at our Berkeley Street Station, in this City, or on any of the Railways in this Province by which it is used. It is my desire that you may be satisfied that all that is claimed for the " HAGGAS WATER ELEVATOR " is fully sustained by facts and results of the most convincing and satisfactory character.

Yours respectfully,

WILLIAM GOODERHAM, JR.

RULES TO BE OBSERVED

IN OPERATING THE

"HAGGAS PATENT WATER ELEVATOR" FOR LOCOMOTIVES.

1. The Elevator must be properly attached to the Locomotive and Tender ; and great care must be taken to have all the *joints perfectly tight*, especially as regards the suction hose.

2. The water should not be more than ten (10) feet from the rail level ; the nearer the water is to the rail the better for the effective working of the system.

3. *Good dry steam is necessary*, and in order to secure this, *a good fire*, such as is used in hauling a full train, is required. In order that the steam may not run down, *the blower should be put on*.

4. If the foregoing conditions are carefully observed, from four hundred to four hundred and fifty gallons of water per minute can be run into the Tender, and the temperature of the water will be increased about thirty degrees.

5. Two underground tanks are required, one on each side of the track, connected with a pipe at the bottom ; the tanks have an air space of two feet from the top, which renders them perfectly frost-proof in any climate. Where there is a good supply of water the tanks should be made 10 x 10, according to plans which I shall be glad to furnish.

6. If there should be any difficulty about muddy water, we put in a filtering tank, through which the water passes before it reaches the tank proper, and in which the sediment deposits. The filtering basin is so constructed as to admit of its being easily cleaned out as often as occasion may require.

WM. GOODERHAM, JR.

THE CERTIFICATES

Supplied by the undermentioned gentlemen will be found on the pages the numbers of which are placed opposite their respective names.

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CERTIFICATES.

TORONTO AND NIPISSING RAILWAY.

TORONTO, 14th March, 1879.

We, the undersigned, were present at a test of the "Haggas Water Elevator," made this 14th day of March, 1879, at Berkeley Street Station, and do certify that Engine No. 8 filled her tender, said to contain 1,750 gallons, with water, in three minutes and forty-five seconds, increasing the temperature of the water from 42 to 69 degrees without lowering the pressure of steam in the boiler.

We see no reason why this system should not do away with the necessity of erecting and maintaining the present system of elevated tank-houses.

FRANK SMITH,
President N. R. C.

J. C. AIKINS,
Senator.

JAMES ROSS,
Chief Engineer and Manager
Victoria Railway.

TORONTO AND NIPISSING RAILWAY.

TORONTO, 26th March, 1879.

We, the undersigned, were present at a test of the "Haggas Water Elevator," made at Berkeley Street Station, this 26th day of March, 1879, and hereby certify that Engine No. 8 elevated 1,750 gallons of water into the tender in four minutes and fifteen seconds, increasing the temperature of the water from thirty-four

(34) to sixty (60) degrees, without lowering the pressure of steam in the boiler.

C. S. GZOWSKI.

F. SHANLY, C.E.

EDMUND WRAGGE, M. Inst., C.E.,
General Manager and Chief Engineer
T. G. and B. R.R.

VERNON SMITH, C.E.

J. C. BAILEY,

Chief Engineer C. V. R. R.

W. H. ELLIS, C.E.

JNO. HARVIE,

Traffic Master N. R. C.

W. C. HOLT,

Locomotive Foreman G. T. R., Toronto.

D. PRESTON,

Master Mechanic T. G. and Bruce R.R.

DONALD C. RIDOUT,

of Ridout, Aird & Co.

TORONTO AND NIPISSING RAILWAY.

TORONTO, 5th April, 1879.

We, the undersigned, were present at a test of the "Haggas Water Elevator," at Berkeley Street Station, this 5th day of April, 1879, and hereby certify that Engine No. 8 filled her tender, said to contain 1,750 gallons, with water, in three minutes and fifty seconds, increasing the temperature of the water from 34 to 60 degrees, without lowering the pressure of steam in the boiler.

COLLINGWOOD SCHREIBER,

Chief Engineer of Government Railways.

EDMUND WRAGGE, M. Inst., C.E.,

General Manager and Chief Engineer

T. G. & B. Railway.

GEO. P. BLACK,

Intercolonial Railway.

TORONTO AND NIPISSING RAILWAY.

TORONTO, 10th April, 1879.

I, the undersigned, was present at a test of the "Haggas Water Elevator," at the Berkeley Street Station, on this 10th day

of April, 1879, and do certify that Engine No. 8 did elevate into the tender 1,750 gallons of water, in four minutes, increasing the temperature of the water from 39 to 65 degrees, without lowering the pressure of steam in the boiler; and when water can be had within ten feet of the rail I see no reason why this system should not do away with the necessity of erecting and maintaining the present elevated tank-house system.

We have eleven of our engines equipped, and they give perfect satisfaction.

P. CLARKE,
Mech. Supt. Northern Ry.

MONTREAL, 26th June, 1879.

DEAR SIR,—I have much pleasure in saying, that, whilst I was General Superintendent of Government Railways, I gave directions to test upon the Intercolonial Railway your patent water elevators.

They were put in use, having proved to be everything you represented them to be, and I am quite satisfied they are a most valuable invention, and will prove, wherever adopted, a great saving of expense to Railway Companies in regard to their water service.

By the application of this cheap and simple expedient the Tender of an engine can be filled, from a well which is not more than twelve feet below the surface of the rail, without the necessity of using pumps, tanks, or any apparatus of that kind.

The wear and tear of tanks, pumps, etc., and the necessity for keeping them from freezing in winter are very expensive, all of which is avoided by the use of your patent elevator. I have no hesitation in saying that I consider it a most valuable invention, and one which I shall be very glad to hear meets with the success which it so undoubtedly deserves.

Yours truly,
C. J. BRYDGES.

(Signed),

To W. GOODERHAM, JR., Esq., Toronto.

QUEBEC, July 28th, 1879.

W. GOODERHAM, JR.,
President T. and N.R., Toronto.

DEAR SIR,—With regard to the working of the "Haggas Water Elevator" on the North Shore Railway during the time I

was Mechanical Superintendent, the cause of the trouble on that line was owing to the contractor neglecting to protect the underground tanks against frost. With this exception it worked satisfactorily.

I have no doubt it will effect a great saving in water service to any road adopting it.

Yours truly,
(Signed), E. HARDMAN.

JERSEY CITY, N.J., November 3, 1879.

As per your request I take pleasure in stating that the "Haggas Water Elevator," which Mr. Garvin has put up for trial on our road, at Clarksville, works well, and I am satisfied that it is a good thing.

This Company will undoubtedly purchase the right for the Road.

Wherever the water can be brought within eight (8) feet or less below the rail, I have no doubt but that it will give entire satisfaction.

The water where the Elevator is working is six feet below the rail, and furnishes the water in abundance, and as fast as the ordinary supply is delivered from an elevated tank.

The temperature is raised in the tender some 30°, and that of course has some value.

I consider the apparatus of great value wherever the water is plenty and lies not lower than eight feet below the rail. I recommend it as being efficient and cheap.

Yours very truly,
(Signed), D. E. CULVER,
Manager, The Jersey City and Albany Ry.

JERSEY CITY, N. J., Nov. 7, 1879.

The following is the result of a test made with the "Haggas Water Elevator" on the Jersey City and Albany Railway, October 21st, 1879.

	Ft.	In.
Surface of water below rail, in brook, about	6	0
Depth of engine tank.....	3	0
Depth of water in engine tank when attachment was made		9
Depth of water required to fill tank.....	2	3

	Hrs. Min.
Commenced filling tank.....	4 1
Completed filling tank.....	4 4½
Time consumed in putting in 2 ft. 3 in. water.....	3½
	Degs.
Steam gauge when test commenced stood at.....	133
Steam gauge when test completed stood at.....	128
Steam (with blower on) ran down.....	5
Temperature of water in brook.....	51
Temperature of water in tank after filling.....	80
Temperature of water increased by process.....	29

Respectfully yours,
(Signed), C. DE CLARK,
Agent.

NEW YORK, N. Y., NOV. 11, 1879.

I have seen your "Water Elevator" tested, and fully concur with Messrs. De Clark and Culver as to its giving entire satisfaction, and as a practical R. R. builder would recommend its use to all persons operating or constructing Railroads.

Respectfully yours,
(Signed), THOMAS P. SIMPSON.

MIDLAND RAILWAY.

President and Managing Director's Office.

PORT HOPE, January 22nd, 1880.

W. GOODERHAM, JR., Esq.,
President T. & N. Railway.

DEAR SIR,—Referring to your favour of the 21st, requesting my opinion of the "Haggas Patent Water Elevator" on our road, the opinion I first formed has been fully confirmed; it has done all that you claimed for it.

By adopting this system we have been able to close every tank house, ten (10) in number, on the line; have displaced all our pumpmen, and our expense for water service is now comparatively nothing.

The drivers, who were at first very much prejudiced against this system, are now pleased with it. Having the water, raised by the Elevator, heated about 30°, enables them to work their engines

to better advantage, and they take water as fast as they did with the overhead tanks.

I consider the Elevator a valuable invention, exceedingly simple in construction, thoroughly efficient in working, and will save the cost of erecting, equipping and the *daily* expense of maintaining elevated tanks.

We have used it in summer and winter and find the underground tanks perfectly frost-proof.

The "Haggas" system should be generally adopted. I shall be glad to give any further information.

Yours faithfully,

(Signed), GEO. A. COX,
President & Managing Director.

GRAND JUNCTION AND BELLEVILLE & NORTH
HASTINGS RAILWAYS,

General Superintendent's Office.

BELLEVILLE, 26th January, 1880.

W. GOODERHAM, JR., Esq.,

President T. & N. Railway, Toronto.

DEAR SIR,—In reply to your favour of the 23rd—the "Haggas Patent Water Elevator" has been in operation on these roads sufficiently long to prove its value, and has accomplished all you claimed for it. I have much pleasure in stating that it gives general satisfaction. The drivers report that they take water as fast as by the overhead tanks; they have no trouble and are well pleased with the system. Your underground tanks are especially adapted for cold climates, and are much better than the overhead frost-proof tanks, and where water can be had within ten (10) feet of the rail level, I see no reason why this system should not entirely supersede the present expensive elevated tank-houses.

In the construction of new roads the "Haggas" system would do away with the large expenditure for overhead tanks and equipments.

The cost of fitting up these roads was only one-tenth (1-10) of the old plan, and the maintenance a mere trifle as against \$30 per mile per annum.

Yours truly,

(Signed), R. LUTTRELL,
General Supt.

HUNTINGTON, IND., Feb. 22nd, 1880.

I hereby certify that I have tested the "Haggas Water Elevator" now in use on the Chicago and Atlantic Railroad, and find it is all you claim for it, giving perfect satisfaction.

I am satisfied that wherever water can be procured within ten (10) feet of the rail level it will answer all the purposes of elevated Tanks, and at a much less expense both for construction and general use.

Very respectfully yours,
(Signed), ROBT. SIMONTON,

TORONTO & NIPISSING RAILWAY.

TORONTO, 5th March, 1880.

I was present at a test of the "Haggas Water Elevator" at Berkeley Street Station, and do certify that an Engine filled her Tender, holding 1,750 gallons of water, in four minutes, increasing the temperature of the water about 28 degrees without lowering the pressure of steam in the boiler, the blower being on less than half the time; and when water can be had within ten (10) feet of the level of the rail I see no reason why this system should not do away with the necessity of erecting and maintaining the present expensive elevated tank-house system.

(Signed), J. H. RAYMOND,
Secretary Western Railroad Asso.
Chicago, Ill.

CREDIT VALLEY RAILWAY,

Superintendent's Office,

TORONTO, 10th March, 1880.

W. GOODERHAM, JR., Esq.,
Toronto and Nipissing Ry., Toronto, Ont.

DEAR SIR,—From my previous knowledge of the "Haggas Water Elevator" on the Victoria Railway, I recommended its adoption on the Credit Valley Railway.

The estimated cost of equipping this Railway with the elevated tanks was \$10,000, and the annual maintenance \$3,000.

The Railway has been equipped with the "Haggas Water Elevator" for about \$1,500, and the annual maintenance is comparatively small.

I have not had time, owing to illness, to examine its working all over the Railway, but will be able to do so at an early date, and will write you.

Yours faithfully,
(Signed), JAS. ROSS, Supt.

HUNTINGTON, IND., March 11, 1880.

I hereby certify that we are using the "Haggas Water Elevator" on our road, and it gives entire satisfaction.

The engine to which it is attached has a tank capacity of 1,000 gallons, which the elevator readily fills in less than $2\frac{1}{2}$ minutes, at the same time materially increasing the temperature of the water, thus making it easier to raise steam.

We are well pleased with it, and I see no reason why it should not entirely supersede the ordinary expensive elevated tank system whenever water can be procured within say ten (10) feet of rail level. Given this condition, and it does away entirely with the cost of water maintenance.

The elevator fully performs all you claim for it; our water supply now costs us literally nothing.

I am, Sir, yours truly,
(Signed), CHAS. H. CORNWELL,
Assistant Secretary.

TORONTO, 16th March, 1880.

DEAR SIR,—I have had the pleasure of observing your "Haggas Patent Water Elevator" in operation. I was particularly struck with the rapidity with which the tender was filled, and also with the great simplicity of the whole machinery, its freedom from complication and liability to damage.

Coming from Manitoba, I was prepossessed, before seeing it, with the idea that it was not practicable in cold climates. I am now fully convinced that it is much more adapted to the North-West climate than any other system of tank-house can possibly be.

In my opinion the Government need not hesitate a moment in applying the "Haggas" system to the Canada Pacific Railway; they will in so doing secure a reliable water supply at a minimum cost.

I would also say, that it would be a great improvement upon the system of Windmills now in operation upon the Prince Edward Island Railway, of which I was formerly Superintendent. I consider it as great an improvement over windmills as they have proved to be over hand pumping.

I write this advisedly. I have had some twenty-seven (27) years' experience in railway business.

Yours very truly,
(Signed), W. McKECHNIE.

To W. GOODERHAM, JR.,
Manager, T. and N. Ry., Toronto.

CANADA PACIFIC RAILWAY.

Office of the Engineer-in-Chief.

OTTAWA, March 18, 1880.

W. GOODERHAM, JR., Esq.,
President T. and N. Ry.

DEAR SIR,—In reply to your request, I beg to state that I have examined the "Haggas Patent Water Elevator," and was so much pleased with the working and simplicity of the system that I had no hesitation in recommending its adoption for the C. P. Railway, and I am confirmed in this opinion by what it is doing on the many railways now using it exclusively. I am satisfied that it would save the Government a large sum of money in the erection of elevated tanks, as well as in the annual maintenance thereof. The only doubt I had was the possibility of the water freezing; but am now satisfied that the underground tanks are free from this objection, and are well adapted for cold climates.

Yours very truly,
(Signed), MARCUS SMITH,
Deputy Engineer-in-Chief, C.P.R.

TORONTO & NIPISSING RAILWAY.

TORONTO, 22nd March, 1880.

I was present at a test of the "Haggas Water Elevator" at Berkeley Street Station, and do certify that an Engine filled the Tender, holding 1,750 gallons of water, in four minutes, without lowering the pressure of steam in the boiler.

When water can be had within ten feet of the rail level I see no

reason why this system should not be used, especially where there is a necessity for erecting and maintaining expensive elevated tank-houses, and raising the water by pumping.

(Signed), O. CHANUTE,
Chief Engineer and Asst. Gen. Supt.,
New York, Lake Erie & Western Railway.

OFFICE OF WALTER SHANLY, CIVIL ENGINEER.

MONTREAL, 25th March, 1880.

I had occasion recently to examine and note the working of the "Haggas Water Elevator" when making a professional inspection of the Midland Railway of Canada. This new mode of watering Tenders is in use all over the Midland, where it gives complete satisfaction. The invention is certainly a valuable one in Railway economy, and unless where exceptional local conditions happen to be adverse, will, in my opinion, come into very general use.

(Signed), W. SHANLY.

WHITBY, PORT PERRY & LINDSAY RAILWAY.

General Offices.

WHITBY, ONT., 14th April, 1880.

W. GOODERHAM, JR., Esq., Toronto.

DEAR SIR,—We have had the "Haggas Patent Water Elevator" in operation on this line for the past ten months. It has given entire satisfaction ; perhaps the best evidence I can give you of this is that I have had no complaints whatever.

Yours truly,

(Signed), J. J. ROSS,
Secretary.

TORONTO, 12th May, 1880.

DEAR SIR,—In reply to your communication, accompanied by a number of papers referring to the "Haggas" system of supplying water for the use of Locomotives, I beg to say that I have read the papers, and that I thoroughly coincide with the opinions of Mr. O. Chanute, Chief Engineer and Superintendent of the New York, Lake Erie and Western Railway, and of Mr. Walter Shanly, as to the rapidity with which a Locomotive tank can be supplied

with the requisite quantity of water, without materially lowering the pressure of steam in the boiler, and as to the economical construction of the tanks and attachments to the Locomotive.

"Haggas'" mode of supplying water, where it can be had within the ten feet of rail level, is undoubtedly most economical and efficient, and I unhesitatingly should adopt it on a Railway under conditions where water can be brought to the Water Stations by gravitation at a cost equal to the cost of erecting frost-proof tanks, pumping apparatus, and the cost of maintaining them.

The use of the "Haggas" system where pumping into the underground tanks becomes necessary, is also, in my opinion, the most economical mode for supplying water for Locomotives.

If pumping has to be resorted to, it is more economical to pump into an underground tank, which costs much less than one overground and which needs no attendance; while the Locomotive, being already fitted with the "Haggas" system, requires no additional appliances.

The "Haggas" system is unquestionably the most economical and convenient, under almost all circumstances, for the supply of Water Stations. I approve of the mode of putting in double tanks and connecting them, and consider their capacity, 25,000 gallons each tank, as sufficient for all ordinary requirements.

I remain,

Yours truly,

(Signed),

C. S. GZOWSKI.

To W. GOODERHAM, JR., Esq.,

Managing Director, T. & N. Railway.

ENGINEER'S OFFICE, NORTHERN & NORTH-
WESTERN RAILWAYS.

May 12th, 1880.

DEAR SIR,—In answer to your letter of the 10th inst., conveying a request that I should give you my opinion of the "Haggas Water Elevator" for supplying Locomotives, and its special value as a system for adoption on the Canadian Pacific, I beg to reply as follows:—

You are aware I have used the "Haggas Water Elevator" for several years on the Northern Railway and Branches; during

construction I found it invaluable, and its use will always effect a large saving in train mileage and consequent cost of maintenance, particularly in track-laying and ballasting. The system is now extensively used on the whole line, and, with the underground tanks, is found to work satisfactorily; its economy in first cost, and afterwards in maintenance, is of course beyond question.

The Northern Railway is exceptionally well equipped with regard to its water service; in sixty-four miles we have five Water Stations supplied by gravity. * * *

My experience with the windmill has led me to use it only when the topography is such that a wind can be depended upon almost continuously, and then a tank of at least 60,000 gallons should be provided. In a confined situation, surrounded by hills or woods, the mill is comparatively useless. Near the mouth of a large stream or on the shores of a lake it will be found tolerably efficient. *We have placed the "Haggas Elevator" at one or two of the Windmill tanks for use when the wind fails to provide a supply.*

The steam pump is, in my opinion, the worst system of all for general use, except perhaps at some large terminal station where water cannot be obtained by gravity; the first cost is large and the maintenance extravagant and wasteful in the extreme; the annual expenditure for one station, in wages, fuel, oil and waste, will amount to some \$500.

And now with regard to the adoption of the "Haggas Water Elevator" on the Canadian Pacific Railway for the 600 miles under tender, and on the line generally:

I have never been over the line of the Canada Pacific Railway, nor have I any personal knowledge of the climate of the North-West, but from published reports I learn that during the long winters the mercury frequently shows 30° to 45° of frost, and that this intense cold is continuous for months. In my opinion this fact alone should decide the question in favour of your system, certainly on that part of the line exposed to such a temperature.

I scarcely think that any practical Railway man, conversant with maintenance, would hesitate between the two methods of supplying Locomotives with water in winter, when by the "Haggas Elevator" system you have the water raised in temperature by

the protection of an underground cistern and still further warmed by the steam used in drawing it into the tender.

With reference to the great difference in first cost and future maintenance between the two systems I have gone over the estimates and prices furnished by Mr. J. C. Bailey, Chief Engineer of the Credit Valley Railway, for the construction of the frost-proof tanks and windmills, and, from my own experience, find them approximately correct. * * * I should say roughly that the difference in favour of the "Haggas" system would be about \$6,000, annually, on the 600 miles.

In conclusion, I should think you would have little difficulty, with the figures and results you show, in inducing the Government to adopt your Water Service on the Canadian Pacific, wherever the nature of the country allows it to be used with efficiency.

Yours truly,

OWEN JONES,
Chief Engineer.

WM. GOODERHAM, JR., Esq.,
Managing Director T. & N. Ry.

MONTREAL, 14th May, 1880.

DEAR SIR,—I have carefully considered the papers you sent me showing the advantages claimed for the "Haggas Water Elevator" as the best means, under all circumstances, for watering Locomotive Engines.

In a former letter I stated my belief that, local conditions being favourable—that is to say the natural surface of the water whence supply has to be drawn not too far below the rail level—this new device is a decided improvement in economy, and simplicity, over the old plan of water station.

You now ask me whether the "Haggas" plan may not also be the best where the natural water surface is too low down to be acted on directly by it; where, if pumping must be resorted to, a saving of expense is not to be effected by pumping into an underground tank, where the water can be reached by a "Haggas Elevator" pipe instead of into the elevated receiver now in general use, and whence the Engine tank is supplied by gravitation. I

answer "yes." The first cost of underground tank will certainly be less, as much as \$1,000 less in most circumstances, than that of the elevated one. The annual cost of maintenance would also be largely in its favour. Economy in these two conditions, first cost and maintenance of the water station, being on the side of the water tank, and the superiority of the "Haggas" mode of supplying the engine tank being admitted, it follows that pumping, where pumping is unavoidable, had better be done into the underground receiver than into the overground one at thirty feet greater elevation.

I therefore consider that all appearances are now in favour of using the "Haggas Water Elevator" as well where pumping has to be done as where the water is naturally within its reach.

Yours truly,

W. SHANLY.

WM. GOODERHAM, JR., Esq.,

President, T. & N. Railway.

CITY ENGINEER'S OFFICE.

TORONTO, 19th May, 1880.

W. GOODERHAM, JR., Esq.,

President, T. & N. Railway.

DEAR SIR,—I have your letter of this date, enclosing the written opinions of Messrs. C. S. Gzowski and Walter Shanly on the "Haggas" system of watering Locomotive Engines on Railways. These opinions are so exhaustive of the subject that it is unnecessary for me to add anything further than that I entirely concur in them. Having frequent opportunities of seeing the working of the Elevator, I am convinced for economy and speed, it is superior to the old method; and, with the addition of wind-mill pumping arrangements, where required, the system is as perfect as can be desired.

The opportunity thus afforded to new roads to effect a large saving in first cost, and future maintenance, is one that, in my opinion, should not be neglected.

Yours truly,

F. SHANLY.

TORONTO, GREY & BRUCE RAILWAY.

General Manager's Office.

TORONTO, 24th May, 1880.

DEAR SIR,—I am in receipt of your communication, accompanied by several papers referring to the "Haggas Water Elevator," including copies of letters on the subject from Col. Gzowski and Mr. Walter Shanly. I quite coincide with the views of these gentlemen; and as the system will have been in operation upon this road for two years next autumn, without having cost anything for repairs, beyond a little work at one or two of the tanks, owing to their being hurriedly put down late in the season, I can bear testimony not only as to the thorough efficiency of the system, but also as to its economical aspect.

I see no necessity for any other system being used on any Railway.

I am, dear sir,

Yours truly,

EDMUND WRAGGE,

General Manager and Chief Engineer.

By adopting the "Haggas" system on this road we were able to discharge ten men, to dismantle twelve tank houses, and discontinue running five steam pumps. The estimated saving during the time of the patent is over \$120,000.

E. W.

CREDIT VALLEY RAILWAY.

Superintendent's Office.

TORONTO, 14th June, 1880.

WM. GOODERHAM, JR. Esq.,
President, T. & N. Ry., Toronto.

DEAR SIR,—I have read over carefully the opinions of Mr. Walter Shanly, Col. Gzowski, and others, on the advantages of the "Haggas Water Elevator," and I fully endorse what they say about it.

I have now used it for three years on the Victoria and Credit Valley Railways, and consider it to be a most valuable factor in the economical operations of a Railway.

If the elevation of the water will not admit of its being forced directly by the Elevator into the tank of the Tender, your propo-

sition to use underground tanks filled by windmills or small engines is quite feasible, and will be a very large saving over the using of elevated tanks.

At the present time our trains on the Credit Valley Railway are making, on the average, running time of twenty-five miles per hour, including stops, this being as fast as the ordinary running of passenger trains in Canada, showing quite plainly that the elevators can be used to advantage on any line in the country.

Yours truly,

JAMES ROSS,

Supt. Credit Valley Railway.
Manager Victoria Railway.

By the adoption of the "Haggas Water Elevator" this road saves during the term of the patent, computing interest at 7 per cent. half yearly, over \$100,000.

J. R.

TORONTO, 17th June 1880.

W. GOODERHAM, JR., Esq.,
President, T. & N. Railway.

DEAR SIR,—Referring to yours of the 15th ult., and having read the opinions of Walter Shanly, Esq., Col. Gzowski and that of Mr. Chanute, Chief Engineer of the New York and Erie Railway, as to the economical value of the "Haggas Patent Water Elevator" for use on Railways, and from personal observation, I am led to concur in the opinions expressed by those gentlemen regarding the economical value of said patent for Railways.

I am,

Yours truly,

ALEX. MANNING.

ONTARIO & PACIFIC JUNCTION RAILWAY.

TORONTO, 18th June, 1880.

W. GOODERHAM, JR., Esq.,
Managing Director T. & N. Ry.

DEAR SIR,—You ask my opinion of the "Haggas Water Elevator:"

I have not yet had an opportunity of using it; but I have seen it working most satisfactorily on many occasions.

I consider it a very valuable invention, and in time, no doubt, it will be adopted by all Railways.

The saving in expense, both in original cost as well as in labour of maintenance, as compared to the present elevated tank system, is greatly in favour of the "Haggas Elevator."

On construction trains this Elevator would be superior to any other method hitherto in use.

We propose to use the "Haggas Water Elevator" as soon as our line is in running order.

Yours very truly,

C. W. MOBERLY,

Chief Engineer, O. & P. Junct. Ry.

TRANSLATION.

TORONTO, 18th July, 1880.

I know the "Haggas Water Elevator" some eight months, and have only six months ago recommended its introduction to the Royal Prussian States Railroads Management. After witnessing the application of the apparatus at the Toronto & Nipissing Railroad—after practically testing its performances,—my favourable opinion has now been strengthened, and I consider it one of the most useful lately invented provisions for the management of Railroads.

(Signed),

M. M. BARON VON WEBER.

CERTIFICATE.

I hereby certify and declare the above to be a literal and true translation of the original, herewith attached, and I furthermore certify and declare the original to be a genuine and true certificate of Baron Von Weber, a Privy Councillor of the Royal Prussian Department of Public Works, personally known to me, as also that said certificate was handed to me in person by Baron Von Weber on the 18th July, A. D. 1880, for transmission to Wm. Gooderham, Jr., Esq.

J. A. SIMMERS,

The Imperial German Consul.

Toronto, Province Ontario, Canada,
the 20th July, 1880.

NEW YORK, ONTARIO AND WESTERN RAILWAY.

TORONTO, 27th July, 1880.

W. GOODERHAM, JR.,

President T. & N. Ry., Toronto, Ont.

DEAR SIR,—We, the undersigned, were present at a test of the "HAGGAS WATER ELEVATOR," at Berkeley Street Station, on this twenty-seventh (27) day of July, and do certify that Engine No. 10 did elevate into the tender 1,750 gallons of water in four (4) minutes and ten (10) seconds, increasing the temperature of the water from 65 to 90 degrees, without lowering the pressure of steam in the boiler.

Where water can be obtained at the proper distance from the rails, I see no reason why this system should not do away with the necessity of erecting and maintaining the present expensive system of elevated tank houses.

(Signed),

C. W. LANPHER,

Supt. N. Y., O. & W. Ry.

E. MINSHULL,

M. M. N. Y., O. & W. Ry.

TORONTO, August 7th, 1880.

This is to certify that Engine No. 10 put into her tender, with the "HAGGAS WATER ELEVATOR," 2 feet 4½ inches, or 1,350 gallons of water, in three minutes, increasing the temperature from 72 to 102 degrees, with steam in the boiler at 130 lbs., without lowering the pressure. (Temperature gained 30 degrees). The tender was then emptied, and filled with the same quantity of water from the City Water Works, at a temperature of 65 degrees, and the steam turned through the same steam-cock into the tender, under the same conditions as the above, and for the same time, 3 minutes; the water was increased in temperature to 95 degrees. (Temperature gained 30 degrees.) Thus proving that when the increased temperature gained is utilized, that the water is obtained free of cost.

(Signed),

WM. C. HOLT,

Locomotive Foreman G.T.R.

JOHN DUNCAN,

Traffic Supt. T. & N. Ry.

NEW YORK, Sept. 22nd, 1880.

WM. GOODERHAM, JR., Esq.,
Toronto, Ont.

"DEAR SIR,—I have received your letter, and enclosures containing the opinions of such distinguished Engineers as Messrs. Shanly and Gzowski, concerning the 'HAGGAS WATER ELEVATOR,' as a device for supplying Locomotive Tenders with water from underground cisterns, which are to be filled by gravitation where practicable, and by pumping where the source of supply is more than ten feet below the rail level.

"I can see that in the construction of new lines of Railway the adoption of the 'Haggas' system may be attended with considerable economy.

"It would save the cost of overground frost proof tanks, and where the water supply is not more than ten feet below rail level dispense with pumping appliances; while, where pumping is a necessity, it would, upon the whole, be somewhat less expensive to throw the water into underground cisterns than to raise it say thirty feet higher into overground tanks.

"I believe the principal fields for the application of this system will be found to be in the West and South. One great source of expense to Western Railroads arises from the *hardness* of the water which they obtain from wells and springs, the lime and alkali therein contained materially increasing the amount of fuel consumed, and the cost of Engine repairs. It is advisable, in my judgment, wherever the country admits of it, to store the rain water in artificial ponds (generally cheaply secured), from which it may flow into underground cisterns.

"When this method of supply can be adopted, as a general plan, the 'Haggas' system may be the most economical method of taking the water from the ponds or the underground cisterns into the tender, thus dispensing with all investments in tanks, pumps, pipes, etc.; and in such case, for the sake of uniformity, as well as in view of the greater cheapness of first cost, I believe that, even when pumping is necessary, it would be advisable to pump into an underground cistern, rather than into an overground tank.

"In those locations also, either in yards or at large stations, at which overground tanks would be in the way of the connection or extension of tracks, it will frequently be preferable to substitute underground cisterns.

"Under what other circumstances the new system will prove preferable will be a question mainly to be solved by actual test and experience.

"Respectfully,

"O. CHANUTE."

(From the *Daily Globe*, Toronto, Ont., 28th July, 1880.)

THE "HAGGAS WATER ELEVATOR."

(To the Editor of the *Globe*.)

SIR,—I have carefully considered the communication signed "George W. Perkins," which appeared in your issue of the 20th inst. Before reviewing Mr. Perkins' observations upon certain statements contained in my letter of the 8th inst., permit me to make a few remarks with respect to the "Haggas" method of supplying water for locomotive purposes.

The "Haggas" system has been fashioned and brought to its present measure of completeness in this city. That it is a Canadian invention should not lessen its claims to public favour, if it can be shown that all that is claimed for it, on the ground of economy and practical utility, is strictly true. It is fair and right that any new device placed upon the market should be fully examined, and be subjected to the closest scrutiny; but by all means let there be intelligent and honest criticism rather than careless insinuations and untruthful assertions.

The "Haggas" system stands, and is presented to the public, entirely on its own merits. As already intimated, the principal features in its favour are: first, great economy; and secondly, very satisfactory results.

1. Under the head of economy, allow me to direct attention to the following points, viz. :—

On railways under construction the entire cost of tank houses and pumping machinery of the ordinary description varies from \$60 to \$100 per mile, and of maintenance from \$30 to \$50 per mile annually.

On established railways where tank houses, etc., have already been built, the maintenance of the water service costs from \$30 to \$50 per mile per annum. This outlay is nearly wiped out by the use of the "Haggas" system.

By adopting the "Haggas" method, the cost of placing underground cisterns fifteen miles apart, and equipping one engine for each ten miles of railway, is about \$15 per mile, and the subsequent outlay for maintenance is so trifling as to represent less than \$2 per mile per annum.

By way of illustration:—On a new railway of one hundred miles in length, the expenditure for frost-proof tanks and pumping machinery under the former method would be about \$7,000. By the use of the "Haggas" system the underground cisterns and the other necessary appliances would cost, say, \$1,500. Then with respect to the maintenance of the water supply, the old plan would entail an outlay of fully \$3,000 a year; whilst by the "Haggas" method the expense would not exceed \$200 per annum. Surely, so far as economy is concerned, such an exhibit cannot fail to be entirely satisfactory.

The results above set forth are obtained where water can be had within ten feet of the rail level. It will of course happen that in some localities it cannot be had so near the rail level, and that the water supply must in consequence be taken from a greater depth; but even in these exceptional circumstances underground cisterns of suitable capacity, instead of expensive frost-proof over-ground tanks, will be found to effect a very large saving.

2. With respect to results. From careful observation and test, extending over a period of two years, the efficiency and advantages of the "Haggas Water Elevator" have been fully established. I have in my possession a large number of certificates, received from eminent civil engineers, railway managers, and master mechanics who have carefully investigated the

"Haggas" system, in which the value of the new method, under all circumstances, is set forth. These certificates I shall be most happy to show to any person desirous of examining them.

I may here mention the names of some of the gentlemen who have favoured me with certificates, viz :—C. S. Gzowski, C.E. ; Walter Shanly, C.E. ; F. Shanly, C.E. ; C. Schreiber, C.E., Chief Engineer C.P.R. ; J. H. Raymond, Sec. Western Railroad Association, Chicago, U.S. ; MM. Baron VonWeber, of the Royal Prussian Department of Public Works, Germany ; O. Chanute, C.E., Asst. Gen. Supt. and Chief Engineer N. Y. and L. E. and Western Railway, New York, U. S. ; O. Jones, C. E., Chief Engineer N. and N. W. Railways ; E. Wragge, C. E., General Manager T., G. and B. Railway ; J. C. Bailey, C.E., late Chief Engineer C. V. Railway ; Marcus Smith, C.E., C. P. Railway ; V. Smith, C. E., and James Ross, General Manager Victoria Railway.

The importance of adopting a thoroughly effective as well as an economical water service for the supply of locomotives on the Canada Pacific Railway on the one hand, and the incorrect and unwarrantable remarks which have been made by your correspondents with respect to the "Haggas" system on the other, prompt the desire to place before your readers extracts from the certificates received from the gentlemen above named ; but rather than trespass too largely upon your valuable space the quotations are omitted.

I shall now proceed to notice as fairly and briefly as possible the exceptions taken by Mr. Perkins to the statements contained in my letter of the 8th inst. :—

1. I am reminded that tenders were invited by the Department of Railways and Canals for the supply of about 650 miles of the Canada Pacific Railway, including the erection of thirty or forty water tanks, pumping machinery, &c. This is correct. I gave, inadvertently, the estimated water supply required at the present time, namely, 140 miles of railway, embracing ten water stations. The proportions are nearly the same, and the general results are correctly stated in my former letter. The measure of

saving claimed by using the "Haggas" system applies alike to short or long distances.

2. It is stated that I did not tender for the work according to advertisement. That is true. I pointed out and produced evidence of the most convincing character that the "Haggas" system would afford the best possible supply of water service at a very small expenditure as compared with the outlay that would be necessary to provide over-ground frost-proof tanks, pumping machinery, &c. My tender was also sent to the Department within the prescribed time.

3. Mr. Perkins repeats the insinuation previously made by "W," "that Mr. Gooderham and Sir Charles Tupper understand each other," whatever that may mean. The Minister of Railways and Canals was most exacting in his demands that satisfactory proof should be supplied with respect to the efficiency and completeness of the "Haggas" water system. The Minister, moreover, personally examined everything pertaining to the new device with care and thoroughness. After an exhaustive enquiry the "Haggas" method was adopted, and the contract for supplying the water service required for the Canada Pacific Railway was awarded to the undersigned.

4. It would be a mere waste of time and space to repeat what has been already advanced in reference to the patents which cover the new device in Canada, the United States, and Europe, or as to the validity of the patents. I am prepared to satisfy Mr. Perkins, or any other individual, on that score.

5. Mr. Perkins has the hardihood to state "as regards the twenty railways using his system, I think they must be located somewhere in his (Mr. Gooderham's) mind. I believe that we have about that number of roads in the country, and if I mistake not I could mention about three-fourths of them as non-users, leaving to him one-fourth—which is the percentage of fact to be credited to his letter." Mr. Perkins, to put it mildly, is not well informed upon the subjects introduced in his communication. The Government returns give the number of the railways in the Dominion as 53—nearly three times the number stated by Mr. Perkins. And I repeat that nearly twenty railways in Canada are using, or have

adopted, the "Haggas Water Elevator." The railways using the new device are as follows :—Toronto and Nipissing ; Toronto, Grey, and Bruce ; Credit Valley ; Midland ; Cobourg, Peterboro' and Marmora ; Whitby, Port Perry, and Lindsay ; Prince Edward County ; Belleville and North Hastings ; Grand Junction ; Victoria ; Canada Pacific (for construction purposes) ; Western Counties ; Halifax and Cape Breton ; and the Hamilton and North-Western, (in part) ; and arrangements have been made for putting the Haggas system in operation at once on four additional Canadian railways. The actual saving to the railway companies above named in the item of maintenance alone exceeds \$64,000 a year.

Finally, I may be permitted to add that I shall be happy to show to any person interested in the important matter of water service for railways the "Haggas" system in full operation at the Toronto and Nipissing Railway station, Berkeley street, in this city, in order that complete satisfaction may be afforded that all that is claimed for the "Haggas Water Elevator" is sustained by facts and results of the most convincing nature.

I am, Sir,

Your very obedient servant,

W. GOODERHAM, JR.

TORONTO, 24th July, 1880.

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